

BIOGRAPHICAL SKETCH

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NAME Joshi, Neel S.	POSITION TITLE Assistant Professor		
eRA COMMONS USER NAME (credential, e.g., agency login) neeljoshi			
EDUCATION/TRAINING <i>(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.)</i>			
INSTITUTION AND LOCATION	DEGREE <i>(if applicable)</i>	MM/YY	FIELD OF STUDY
Harvey Mudd College	B.S.	05/01	Chemistry
University of California, Berkeley	Ph.D.	05/2006	Organic Chemistry
Boston University	Postdoctoral	12/09	Biomedical Engineering and Macromolecular Chemistry

A. Personal Statement

The goal of the proposed research is to develop a new biomaterial based on polyaniline nanowires covalently fused to peptide nanotubes for use in neural implants. We hypothesize that this material will exhibit low impedance, high biocompatibility, and the ability to deliver high current densities without generating toxic byproducts, making it ideal for use at the device-tissue interface. I have the expertise, leadership, and motivation necessary to carry out the proposed work. As a graduate student, I developed several new chemical methods to covalently and site-selectively modify proteins and peptides. Some of the reaction methodology that I developed (specifically, a biomimetic transamination reaction that introduces electrophilic ketone/aldehyde groups specifically and the N-terminus of proteins) has been adopted by many biomolecular engineering researchers as a way to immobilize proteins on surfaces with predictable orientations. During my postdoctoral research, I developed new polymeric biomaterials for cartilage tissue engineering, and also developed a new contrast agent for quantitative imaging of glycosaminoglycan content in cartilage using computed tomography (CT). This work has led to, several publications, two patents, and is in the process of being commercialized as one of the first reliable non-invasive methods for the assessment of cartilage health in humans. I have extensive experience as a leader, having started my graduate work in a brand new research group, and mentoring several graduate students and undergraduates as competent experimental researchers.

I began my appointment at Harvard and at the Wyss Institute in January 2010 with the intent to combine my expertise in protein and peptide chemistry with my knowledge of biomaterials development for medical applications to pursue research at the interface of synthetic chemistry, biomolecular engineering, and molecular self-assembly. The materials research proposed here builds logically on my previous work, and I have recruited two postdoctoral researchers with experience in molecular biology and cell biology. Together, we have set up a laboratory with the capabilities to synthesize and characterize the materials proposed here. Additionally, the extensive resources and experienced senior researchers at the Wyss Institute will provide additional expertise with regards to device fabrication. In summary, I have a demonstrated record of successful and productive research projects in an area of high relevance for biomaterials engineering, and my expertise and experience have prepared me to lead the proposed project.

B. Positions and Honors

Positions and Employment

- 2006-2009 Postdoctoral Fellow, Boston University, Boston, MA
2010- Assistant Professor, School of Engineering and Applied Sciences, Harvard University, Cambridge, MA
2010- Core faculty member, Wyss Institute for Biologically Inspired Engineering, Harvard University

Other Experience and Professional Memberships

- 2005 – present American Chemical Society Member
2009 – present Materials Research Society Member
2008 – 2009 Orthopedic Research Society Member

Honors

- 2001 Dorothy C. and J. Arthur Campbell Prize (Harvey Mudd College Departmental Honor)
2001 American Institute of Chemists Foundation Outstanding Student Award
2004-2005 Klaus and Mary Saegebarth Fellowship (UCB Departmental Honor)
2005 UC Berkeley Graduate Division Travel Award

C. Selected Peer-reviewed Publications (Selected from peer-reviewed publications)

Most relevant to the current application

1. Bansal, PN; Joshi, NS; Entezari, V; Grinstaff, MW; Snyder, BD "Contrast Enhanced Computed Tomography Can Predict the Glycosaminoglycan Content and Biomechanical Properties of Articular Cartilage." *Osteoarthritis and Cartilage* 18(2): 184-191. PMID: 19815108
2. Joshi, NS; Bansal, PN; Stewart, RC; Snyder, BD; Grinstaff, BW "Effect of Contrast Agent Charge on Visualization of Articular Cartilage Using Computed Tomography: Exploiting Electrostatic Interactions for Improved Sensitivity." *Journal of the American Chemical Society* 131(37): 13234-5. PMID: 19754183
3. Degoricija, LV; Bansal, PN; Sontjens, SHM; Joshi, NS; Takahashi, M; Snyder, BD; Grinstaff, MW "Hydrogels for Osteochondral Repair Based on Photocrosslinkable Carbamate Dendrimers." *Biomacromolecules*, 9(10): 2863-2872. PMID: 18800810
4. McFarland, JM; Joshi, NS; Francis, MB "Characterization of a Three-Component Coupling Reaction on Proteins by Isotopic Labeling and Nuclear Magnetic Spectroscopy." *Journal of the American Chemical Society* 2008, 130(24), 7639-7644. PMID: 18498164
5. Gilmore, JM; Scheck, RA; Esser-Kahn, AP; Joshi, NS; Francis, MB "N-Terminal Protein Modification Through a Biomimetic Transamination Reaction." *Angewandte Chemie International Edition*, 2006, 45(32), 5307-5311. PMID: 16847857

Additional recent publications of importance to the field (in chronological order)

6. Nguyen, T; Joshi, NS; Francis, MB "An Affinity-Based Method for the Purification of Fluorescently-Labeled Biomolecules." *Bioconjugate Chemistry* 2006, 17(4), 869-872. PMID: 16848391
7. Joshi, NS; Whitaker, LR; Francis, MB "A Three Component Mannich-Type Reaction for Selective Tyrosine Bioconjugation." *Journal of the American Chemical Society* 2004, 126(49), 15942-15943. PMID: 15584710
8. Van Ryswyk, H; Moore, EE; Joshi, NS; Zeni, RJ; Eberspacher, TA; Collman, JP "Surface-Confined Metalloporphyrin Oligomers." *Angewandte Chemie International Edition* 2004, 43(43), 5827-5830. PMID: 15523726

D. Research Support

Ongoing Research Support

Joshi (PI)

William F. Milton Fund

01/01/11-12/31/11

Design and Validation of a Shear Responsive Drug Delivery System

The goal of this research is to investigate the feasibility of a protein-based drug delivery nanodevice or imaging agent that is activated by high shear forces in the human circulatory system.

Role: PI